

BULLETIN No. 30

JOHN BLOOMFIELD JERVIS

MATHEW CAREY

INDEX FOR BULLETINS

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IN presenting this special bulletin, the fifth of this series, we have departed a bit from the previous four issues. The bulletins have always dealt with the history of a railroad—the Michigan Central; Philadelphia, Wilmington & Baltimore; Chicago, Burlington & Quincy and Galena & Chicago Union roads. This bulletin will deal chiefly with a railroad builder—John Bloomfield Jervis, whose biography as related by Mr. Spears cannot help but be of interest to all of us.

Some of our members may be a bit disappointed in the subject matter of this bulletin. After all it was the men who promoted the railroads, the men who built the railroads and the men who ran its locomotives and managed the railroads. Without these men and those who worked on the development of the locomotive, railroads would not exist. The study of their lives is a study of the conditions as they then existed and of the railroad itself. John Bloomfield Jervis was a fine type of character of the pioneer days of railroad construction. Mr. Spears has made an interesting contribution on his life and achievements, hence its reproduction in our columns.

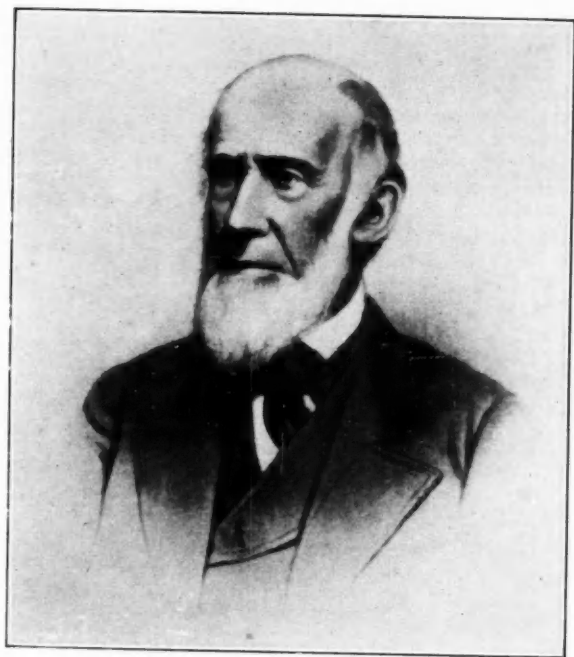
In the early days of the railroad, many were the wild and fantastic schemes that came from the brain of the writers. Project! How often that word is used in cataloguing library material. On the other hand

some of these writers possessed not only great skill with their pens but foresaw clearly the advantages and the value the railroads would contribute to the use of mankind. Mathew Carey was one of these. As early as 1827 he saw the value of a railroad between New York and Philadelphia and his route later was selected by the Camden & Amboy R. R. For that reason we have included his ideas on this subject in this bulletin and we trust it will be of interest to our members.

This is the thirtieth bulletin to be issued by this Society. An index of the material that appeared in the first seventeen bulletins appeared in a special publication in 1929 which listed the material on exhibition in the Baker Library. This index has been included in this bulletin for the use of our members and for those who bind their bulletins as each ten are published.

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John W. Lewis

John Bloomfield Jervis

By JOHN R. SPEARS

IN the long list of civil engineers whose names are recorded in the annals of the American system of steam railroads, there is one who is now remembered in the schools of engineering as the greatest of all who worked during the period before the Civil War. Because he thus became distinguished by work which was extraordinary—by work which was without parallel in several important respects—here is a sketch of his career taken from authentic documents now in the Jervis library at Rome, N. Y.

The name of this engineer was John Bloomfield Jervis.

Jervis was born in Huntington, Long Island, on December 14, 1795, the oldest of seven children. His father, Timothy, was a carpenter and his mother, Phoebe Bloomfield, was of a New Jersey family of note. The family moved to Rome, N. Y., in 1798. Timothy purchased a farm and engaged in the lumber business. The Western Inland Navigation Company had recently opened a canal around the rapids in the Mohawk river, at Little Falls, and another canal which connected the Mohawk with Wood Creek, which emptied into Oneida Lake, and thus furnished a waterway to Lake Ontario and to the Finger Lake region. The people of Rome expected it would develop the upper Mohawk valley rapidly. In due time young Jervis attended the school at Rome where he learned to read, write and "do sums in arithmetic," and not much more. At fifteen he abandoned the school in order to help his father in the forest and on the farm. He was a slender youth—he rarely weighed as much as 125 pounds at any period of his life—but he became an expert in the use of an axe and he was "handy" with a team. An expert axman, by the way, was able to split a chalk line with an over-head blow and to chop down all the trees on an acre of forest land in seven days.

It appears that Jervis was entirely contented with his condition in life until he had learned to run a sawmill which his father bought. The saw was driven by water power and as it slowly rasped its way through the logs the boy came to think that he might educate himself by studying school books during the sawing periods. Accordingly he applied to the minister of the church, of which he was a member, for advice, and was told to buy a Latin grammar. The minister agreed to hear his recitations at night. But after a few days of trial Jervis gave up his ambition—he could not learn the dead language.

In the meantime the people of the central and northern parts of the state had been talking about the construction of a canal from the Hudson River to Lake Erie. The Legislature had appropriated \$600 for a survey of a proposed route across the state and, to the wonder of many intelligent people, the result had been a report favoring the project. Other surveys were made after the War of 1812 had been fought out

and a route had been located as far west as Rome, in 1816, all at the expense of the State. As Judge Benjamin Wright, a citizen of Rome, who had helped to construct the little canals at Little Falls and Rome, had been made chief engineer of the new enterprise, the people of Rome became enthusiastic in their approval of it.

Accordingly on July 4, 1817, the people of Rome brought all their neighbors from the countryside, as far away as Lewis county, to the town to celebrate the digging of the first shovelfull of earth from the "Grand Canal." They were not united in the choice of location through the town, at first, but they agreed upon a point for the digging, and a large crowd assembled to see the ceremony and to hear De Witt Clinton and other great men talk about the matter. When the time came for the digging, the man appointed to use the shovel fumbled it, and at that more than a hundred excited spectators, who had brought shovels of their own, thrust them into the ground and tossed the soil to the four winds of heaven.

That the Jervis family was present, when this occurred, is not doubted, but John B. Jervis does not mention that fact in any of his writing. It is certain, however, that the father, Timothy, was much interested in it, as will appear.

In October of that year Chief Engineer Wright brought a gang of men, experts, to Rome to locate the line from that town as far west as Montezuma, on the Seneca river. Two men to clear the line of the survey of the trees and brush were yet needed and Wright asked Timothy Jervis to recommend men for the job; for Timothy hired axmen every year for his logging work. On his advice his son John and another expert employe were added to the gang. Timothy sent his son because he supposed the young man could learn facts of value when contracts were to be let; for Timothy contemplated putting in a bid for the first section.

It is a curious fact that while the engineers of the early days of railroad construction gave much attention, in their later writings, to embankments, cuts through ridges, the superstructure, and so on, there is but one account of the work of locating a line to be found in the "Transactions" of the American Society of Civil Engineers, and that one was located in Oklahoma. Jervis, in his incomplete autobiography, (manuscript), in the Jervis library at Rome, describes in part the work he did when the Erie canal was located, and W. C. Young, another civil engineer, who was a rodman in the party, also wrote a good description of some of the work.

As the locating of a canal differed but little from that of locating a railroad, it seems worth while to tell briefly what Jervis, the axman, did during this canal survey. Early in the morning of the November day appointed for beginning the survey, the engineer led his crew to the stake at the end of the line that had been located as far as Rome. There were two men to measure the length of the extension of this line with a surveyor's chain; two who carried rods with which the measurements for the contour of the ground were to be made, two axmen, a teamster and a cook. The teamster had a team and a wagon loaded with food, a

tent and other "fixings" needed by the party at night. It was customary to provide a surveyor to run the line of a railroad while the engineer used a level in taking the measurements needed for making the contour line; but Nathan Roberts located the line by eye only where he supposed the land was most nearly level. He then sent the axmen to clear away the trees and the brush along a "trace" four feet wide. These men were followed by the chainmen and then by the rodmen who came last to take the measurements for contour.

The line to be located by this party lay directly to the west, across a swamp ten miles wide, that was covered by a thick growth of cedar trees. Jarvis and his associate therefore did the first stroke of work in locating the line, for they were obliged to cut open the pathway called a trace. They found the ground so soft that they sank in, shoe-top deep, at every step, but with the ambition to show what skilled axmen could do, they "waded in." The trees were felled to right and left and as soon as a path long enough had been opened for the others, they began making pegs for the rodmen who had to have them to support the rods, because if none was used the rods sank in the mud to different depths at every set. The axmen "wobbled" a bit in their efforts to keep the trace straight, at first, but they soon "got the hang of it" and "made the chips fly."

During the first night on the route a clinging snow fell and loaded every branch and twig of the cedars with masses that were thrown down on the axmen with every blow, "and their clothes were all put to soak ready for the first wash" within ten minutes after beginning work—if one may use the frontier vernacular in describing what the axmen did. Jarvis was "putting in his best licks" in order to "get on the blind side" of Engineer Roberts, hoping thus to make easy the gaining of information for his father when bidding for a contract. He was not animated by any other thought, at that time, save only as he may have been proud of his skill and willing to display it.

When the party had crossed the swamp and had found the ground there comparatively free from trees and brush, the axmen had leisure to look on while the others worked. Jarvis had his curiosity aroused by the rodmen. One of them went ahead of the engineer and set his rod on a stake driven at a measured distance from the beginning while the other followed the chief and set his rod at a stake whereat the forward rodman had had his set. Then the engineer set up his instruments, (the surveyor's level), and sighting from one rod to the other he brought the two targets to the exact height of the horizontal hair in his telescope. This done the rodman announced the height of his target above the foot of the rod and made a note of it in a book he carried for the purpose. Jarvis wondered how that work could be of any service; and what was a contour line, anyway?

By observation and by a question modestly asked, now and again, he finally cleared away the mystery of the work. Then with the permission of Engineer Roberts, who had on several occasions spoken with approval of the axman's work, Jarvis took a rodman's place for a time and

manipulated the target. The solution of this mystery led to further observations. Jervis learned thus why the engineer carefully brought, by means of screws, the line through the telescope to an exact horizontal position. He also learned how to make the calculations by which the engineer used the reports of the rodmen to place the contour line on the plat precisely where it belonged at the end of a day's work on the route. It was all extraordinarily interesting to him. Why, the line the engineer was drawing on the sheets of paper would give the "ups and downs" of every rod of land between Rome and Montezuma; and when taken with other sheets made in the same way the chief engineer could see the contour of the whole route, 363 miles long, from Buffalo to the Hudson! No work that he had ever seen had excited his interest as much as this did.

It was then that a worth-while ambition came, though dimly, to the mind of John Bloomfield Jervis. He was 22 years old and he had been contentedly at work, since leaving school, as a farm hand and a lumber-jack, but now he began to wonder whether he might not learn to do the work which Roberts was doing and so become an engineer!

At the end of December the party had located the route of the canal as far as Syracuse, where they were to abandon the survey until settled weather should come in the spring. During the evening of the last day on the line, Jervis became courageous enough to speak to the engineer about the work of the next season. He said:

"What will you give me to go with you next summer and carry one of those rods?"

Roberts answered instantly:

"Twelve dollars a month."

In relating this conversation Jervis makes mention of a curious feature of frontier life at that time. He says he was afraid that Roberts was merely joking when he made the offer of \$12 a month. Employers were known to make a favorable reply to an applicant for work when they had no intention of accepting him; and this was frequently done when the applicant was supposed to be incapable of doing the work. Accordingly on his return to Rome (he walked in order to save the price of stage fare), he went to Chief Engineer Wright and related the conversation. The chief said:

"If you say you *will* go I say you *shall* go."

Feeling secure, now, in his work for the next season, Jervis went to Engineer Roberts and asked him if there were any books to be had which would help him prepare for future promotion. One may venture to say that making that request was one of the most important incidents in the life of this great engineer. It was in a period when many "practical" men spoke with contempt of "book learning" and "mere theorists." Jervis perceived the value of the descriptions of work done by other men in times past.

When he asked Roberts if useful books were to be had, the engineer gave him a list of four or five, any one of which, if mastered, would serve his purpose. *Jervis bought two.* He perceived that each treated the subject from a point of view different from the other.

That was the beginning of a habit which he cultivated as long as he lived. He bought books of every kind needed, or helpful, for self-culture, including works of history, philosophy, art, and religion as long as he lived; and many of his books now show by the marginal notes that he read them with care.

From January 1 to April, 1818, Jervis was employed every working day in hauling wood for fuel to town for sale, and logs to his father's saw mill for the ensuing season. But every workday night he studied, by the light of a tallow candle, the two books on surveying which he had bought, and he learned how to use a set of drafting instruments which he had also purchased. Of course he worked thus on the days when the weather was so inclement that the horses could not endure it. When spring came he was well fitted because of the study, for the season's work, but as he left his home with the rod on his shoulder he saw that some of the neighbors had prepared a surprise party for him. They had held in mind his failure to learn Latin and yet he was now on his way to handle an implement which he had, as they supposed, been trying to learn to use by reading books! They had therefore come, not to encourage, but to jeer him. They laughed sneeringly and when one of them shouted that the ambitious youth would "come home for supper" that night, the others applauded boisterously.

When Jervis sat down to write his life work, sixty years later, that jeering still rankled, and he wrote down the facts. But it is quite certain that when disaster came to him in his work, such as the loss of the Croton dam, at a critical time, he was nerved to take hold anew by that old-time senseless attack.

From the beginning of the work on the canal in April, 1818, Jervis handled the rod as required; at night he made the calculations which the engineer was also making from the notes taken during the day, and thus he became swift and accurate in the work which he would have to do if and when he should be promoted. And because he did this, his superior permitted him to handle the level and thus learn how to use it with needed skill.

But acquiring the ability to do the work of the man next higher in rank, was not, perhaps, the most important feature of this year's work; for he came to have a habit of thought which he described in a book, "Railway Property," which he wrote in 1859 as follows:

"An engineer to succeed well must enjoy his profession and find his chief recreation in the cares, duties and results of his labors."

Kipling, in a vision, saw a future life wherein no one should work for money, and no one should work for fame, but "*each for the joy of the working.*" John Bloomfield Jervis realized, throughout his whole life, as an engineer, the joy which the poet saw in a dream.

When the line of the canal had been located as far as Montezuma, (July 10, 1818), the whole middle section was put under contract, and small surveying parties, each under a surveyor or an engineer, were organized to stake out the side lines of the big ditch, and to see that the contractors did their work properly. Jervis was assigned to work with

a party that was to have charge of a section seventeen miles long. It happened that the surveyor who was with this party had had very little experience in the use of the level, and when he learned that Jervis was fully competent to do that work, it was given to him almost continuously, including the calculations which went with the measurements made. No work on the construction of the canal could have pleased or benefitted the young aspirant more than this.

At the end of the season of 1818, (in December), he was fully competent to take full charge of a section with the rank of "resident engineer," and at the beginning of the next season he was promoted to that post. The neighbors had supposed that this young man had failed to learn to read Latin because he was too stupid to learn anything requiring more brains than that used in swinging an axe and driving a team of horses; they saw now, that in the course of two months of service as an axman, eight as a rodman and such a study of two books as he was able to make in the evenings and on the days of stormy weather, three wintry months, he had *earned* the job of a resident engineer, and he had received it.

Of the further development of Jervis as a builder of canals it may be mentioned that he showed his knowledge of the feed water of the Erie, east of the long level, when he used gravel and sand in constructing banks, and at the ends of locks, where it was supposed that puddled clay was the best material. The banks "leaked like a sieve," at first, but the sediment in the Adirondack waters in time formed a hardpan—cemented the tiny particles of rock together thus making a permanently watertight bank.

He first showed his inventive talent by designing a passageway by which some tributaries of the Mohawk were conducted under the canal, here and there passageways which were self-cleaning. But the important fact was that he enjoyed every hour of his labors and so needed no vacations. Because of this he was made the General Superintendent of the congested eastern division of the canal, in 1824, and was soon ready to leave the canal service in order to move on to some task where he could learn how to build the railroads of which he had been reading.

Jervis left the canal service early in March, 1825. He was immediately employed as chief assistant to Judge Wright who had previously left the canal and was now Chief Engineer of the Delaware & Hudson Canal Company, a corporation which was to construct a canal from Rondout, on the Hudson, to a place called Carpenter's Point, (later named Port Jervis, in honor of this assistant engineer). Thence the line of transportation was to run up the Delaware River to the Lackawaxen, cross the Delaware at that point and continue up the Lackawaxen as far as Dybury creek, where a village named Honesdale was built.

This canal was to be constructed to carry anthracite coal from the mines at Carbondale to the Hudson river and so on to market at New York. But Carbondale was sixteen miles away from Honesdale and a forest-covered ridge rose 900 feet high between the terminus of the canal and the mines. It was impossible to extend the canal over or around

this ridge, but the enterprising leaders in the canal corporation intended to construct a railroad over the rugged ridge and thus bring the coal to the canal.

The early dawn of the American railroad era had appeared; for the builders of the Bunker Hill Monument were to construct a railroad three miles long from the granite quarries at Quincy, Mass., to navigable water in the Neponset River, and in the same period the original Lehigh Coal Company was to make a navigable waterway of the Lehigh River from Mauch Chunk to Easton, on the Delaware, and in the meantime lay a railroad from the village of Mauch Chunk to the coal mines, nine miles away, on Broadtop Mountain. The little stone-carrying road in Massachusetts, and the two little coal carriers in Pennsylvania, were the first tiny roots of the vast railroad plant that is now spread over the nation.

Until 1829 Jervis was fully occupied with the construction of the canal. In the meantime Judge Wright had abandoned this enterprise in order to give his attention to the Chesapeake & Ohio canal, and Jervis became the chief. When ready to prepare plans for the railroad, he had never seen a railroad, but in his collection of British books on engineering he had read descriptions and had seen illustrations which had made him quite familiar with the rail lines in the coal regions at Newcastle and in Wales. Nevertheless the Quincy quarry road had been opened for traffic, and Jervis went to Quincy where he spent a week in making a careful examination of every rod of it.

Two features of this road received especial attention. One was the use of a stationary engine, with rope traction, to lower the loaded cars down a steep plane at the quarry, and the other was the use of what the North American Review called, the bridge across a swamp not far from the river. The latter was the more important, in the view of Jervis, for he intended to use such "bridges" in the construction of about half of the road at Honesdale. As to the stationary engine with rope traction he had ideas of his own which he put in use.

Trestles, as the Quincy "bridge" work came to be called, were to be used on the Honesdale road as a measure of economy. The whole mountainside was covered with great trees, chiefly hemlocks, which could be worked into trestles of more than ample strength, and they would serve the purpose of a roadbed until the company could get out of debt and then replace the trestles with embankments.

For hauling the loaded cars from the mines up the west side of the ridge Jervis used stationary engines and rope traction. On the east side loaded cars were lowered by their own weight which, at the same time, hauled up the empties. At Quincy and at the quarries in England the ropes were wound up on huge drums, when cars were to be hoisted, and the drum was then reversed, of course, when cars were to be lowered. Jervis designed a plan by which the rope travelled continuously up one of the two tracks, on each plane, and down the other. He also invented a new system of brakes for use where the loaded cars were lowered by their own weight. He erected great wheels with fans which were revolved, by the weight of the cars, in the open air, the resistance of which was at first even greater than desirable.

But more important than any other incident in this road's history was the attempt to adopt the locomotive for traction in place of mules. The grades on the summit, on a wide bench on the east side of the ridge, and on a stretch of three or four miles in the valley of the Lackawaxen did not exceed those of roads in England where the steam locomotive was used. At that time the directors of the Liverpool & Manchester road were considering the advisability of using them, but a majority of the board was against the proposition. A commission of two of the best-known engineers in the nation was appointed to examine all the locomotives there in use, and to make a report on their efficiency; and when they had done this they reported in favor of rope traction. In the meantime, a coal road near Newcastle, which had used locomotives, abandoned them because they were less efficient than horses.

Nevertheless, Jervis who had followed the reports of the railroad progress in England as they were printed in the periodicals, decided to advise his directors to import three locomotives. He was helped in coming to this decision by the fact that his chief assistant had decided to go to England to make a study of the railroad system there in use. Thereupon the Delaware & Hudson board appropriated the money to buy the machines and the needed rails at the same time; and the money was entrusted to this young engineer—Horatio Allen, one of the four engineers who were elected honorary members of the American Society of Civil Engineers, when that association was reorganized after the Civil War.

Allen sailed from New York in January, 1828. At Liverpool he met George Stephenson, to whom he gave an order for two locomotives, although the Liverpool & Manchester Railway Company had not yet decided to use them. They were of the type of the famous Rocket, which demonstrated the efficiency of steam locomotives at the memorable Rain-hill trials. Allen then went to Stourbridge and consulted with Foster, Rastrick & Co., builders of steam engines. The Rastrick of this firm was one of the engineers who reported in favor of rope traction on the Liverpool & Manchester road. He offered to construct a locomotive for the American corporation but insisted that it should be of a type materially different from the two already ordered, a type which need not be described here.

Allen sailed from Liverpool soon after giving the orders for the third locomotive, and Rastrick's design arrived in May, 1829. It was set up in the shops of the West Point Foundry Company, in Beech street, and when tested there the machinery worked very well, but the weight was more than 40 per cent greater than the utmost limit specified in the orders, as written by Jervis. Jervis had been insistent upon the limit of the weight because he knew that the habit of mind of the British led them to make their machinery with heavier parts than necessary in the American point of view. However, the contract which Allen had signed compelled the acceptance of the machine and it was sent up to Honesdale for a test.

On August 9, 1829, the day of the test, the locomotive was hoisted by means of a big derrick from the deck of the canal boat, on which it

had come to Honesdale, up to the railroad on the top of a trestle that was 30 feet high above the water in the canal. A vast number of people had gathered to see the trial, and only a few among them believed that the trestle could stand up under the weight of the machine; for when fully loaded with fuel and water and an engineer, the weight was said to be around eight tons. Even the man who had been engaged to run the machine regularly now asked to be excused.

Whether Jervis was present is not definitely stated in the annals but it appears that he was not there. Horatio Allen had come to the place to see the trial and when the engine man flunked he mounted the machine, which had steam up, and sent it flying at full speed along the thirty-foot trestle, around a bend and away into the solitude of the primeval forest. He had had charge of the men who had built that trestle and he knew that it would endure the weight well enough. But when Jervis and his chief assistant examined the trestle, later, they saw that the weight of the machine had pressed the iron ribbon on top of the great wooden (hemlock) rails, down into the wood for a half inch, the full thickness of the iron. So the use of the machine was abandoned. The Stephenson machines were never tested. The records are incomplete but there is ample reason to believe that they were also overweight, and perhaps heavier than the Stourbridge Lion, as Rastrick's engine was named because the front end of the boiler carried a likeness of a lion's face. The fact that the design of the trestle was excellent may be emphasized, for it endured the strains for more than 40 years and carried millions of tons of coal.

Naturally Jervis was much chagrined by the outcome of his effort to give his road the honor of being the first to adopt locomotive traction in America, but the result did not at all injure his reputation; for he was employed as chief engineer of another railroad before he had fully completed his work on the Delaware & Hudson.

This new enterprise was the Mohawk & Hudson, the first link in the great rail system now owned by the New York Central & Hudson River Railroad Co. Of the origin of this enterprise one need only say here that it was designed as a subsidiary or an annex to the Erie canal. It was to take the passengers from the canal packets at Schenectady and carry them over the sandy plain to Albany and the "palatial" steamers bound to New York.

The track as laid was of the approved American type of the day, consisting of wooden rails bearing a ribbon of iron on the upper side, and supported on blocks of cut stone placed close together—three feet center to center. Locomotives were to be used but a path was constructed between the rails for the use of horses if the locomotives failed. To provide one of the locomotives needed, Jervis made a design, and the machine was constructed at the West Point Foundry in New York City. It was named DeWitt Clinton. A duplicate of it was constructed later and has been extensively exhibited by the New York Central people to show the small beginnings of a great enterprise for the service of the nation. While not a perfect success the DeWitt Clinton was as good as

others of the period. The chief trouble was that it was designed to burn anthracite and had to be altered to burn wood, the sparks from which proved to be distressful to the passengers.

When this machine was in hand another, for which detailed plans were made, was ordered from R. Stephenson & Co., the firm organized by George Stephenson, the R. Stephenson being the son of George. When this machine arrived it was even more disappointing to Jervis than the heavy Rastrick machine had been; for it was as much heavier than the one described in the contract as had been the Delaware & Hudson machine. But when he read the letter of instructions sent with the locomotive—instructions dictated by R. Stephenson—even the serious-minded Jervis should have been amused. For this letter carefully described the fire-box so that the American engineer should not build the fire in the foot of the smoke stack. The remainder of the letter showed clearly that Stephenson could not believe the American engineer had common sense.

In spite of his disappointment, however, this locomotive's unwarranted weight and other evil characteristics, led John Bloomfield Jervis to design the first of the long series of locomotives which have enabled the builders to spread the railroad system over the nation for the service of all other industries. Here are the facts:

The wheel base of the imported engine was $4\frac{1}{2}$ feet long. The frame was 12 feet; hence the overhang of the frame was $7\frac{1}{2}$ feet. The firebox was suspended from the overhang abaft the rear pair of drivers. Consequently, when the machine was driven at a speed even as low as ten miles an hour the frame teetered up and down violently, throwing the water in the boiler into the steam pipes leading to the engines, and endangering the life of any one on the footboard, where the engine man was obliged to stand, of course.

To remedy the teetering, it was feasible, in England, to lengthen the wheelbase, because curves there were of long radii. In America, where curves with less than 300 feet radius were laid, the forward wheels of the locomotive with a long wheelbase would cut into the outer rails of the curves and wear away both the rail head and the flange of the wheels quickly, even at the slowest speeds admissible. At the speeds demanded by passengers the wheels would mount the rail and "deviate" from the track, if one may use the favorite word of the "North British Review," when describing the derailling of a locomotive. Jervis saw clearly that some method must be devised to lengthen the wheelbase without increasing the pressure of the flanges upon the outer rail of a curve.

It was also seen that the weight of locomotives must be increased without adding to the weight resting on either of the wheels—a demand that at first seemed utterly impossible to satisfy. In England they gave the locomotive three pairs of wheels, one large pair for drivers under the middle of the frame, and a small pair on each side to support the weight. All the axles were held rigidly to their places on the frame. The wheelbase was thus more than doubled in length, and that prevented the use of the plan in America.

However to spread the weight of a nine-ton locomotive over six wheels, Jervis gave the locomotive a new plan of wheel support. He placed a large pair of wheels under the frame just forward of the fire box, for drivers. For the support of the forward end of the frame he made a four-wheel truck. There were two pairs of small wheels attached to an independent frame after the fashion of the trucks now seen under all sorts of cars, and most of the locomotives of modern times. A strong bolster was laid across the top of the truck frame and a similar bolster was secured under the forward end of the engine frame. To hold the truck bolster in place under the upper bolster a stout iron pin was thrust down through the exact center of the two. The little truck was thus left free to sway to and fro as the locomotive passed around the curves of the track. To ease the bolster friction, roller bearings were used.

Critical visitors told Jervis that the truck wheels would cut into the rails and jam in a way to thrust the rails apart and so create a deplorable wreck. Jervis adhered to his plan and after various experiments he induced the directors to construct a machine which he named the Experiment, but which is now known to fame as the Brother Jonathan. One statement of fact will sufficiently describe the marvelous efficiency of this machine. In a test on a level, straight track it covered a mile in 45 seconds—at the rate of 80 miles an hour, (Stevens, "New York Central Railroad," p53).

This invention was not patented. Other locomotives had been constructed in America before this one appeared, but they had vertical boilers and were not adapted for the increase in size which was needed to haul the traffic of later years. The first of them, (Peter Cooper's) has been called in history the *progenitor* of the long line of locomotives built in America since that time, but that machine was of an entirely different breed. Properly speaking the Brother Jonathan was the progenitor of the modern American locomotive.

British engineers jeered this swinging truck—called it a "bogie," a word which, when translated into the American language, means scare-crow.

Mention must be made of the fact that Jervis was made Chief Engineer of the Schenectady & Saratoga Railroad Company while serving the Mohawk & Hudson. People of wealth and fashion flocked to the springs, there, every summer in such numbers that through trains were run from Albany daily—perhaps the first service of the kind in the nation.

In 1833 Jervis was persuaded to leave the railroad service to become chief engineer of the Chenango canal from Utica to Binghamton, N. Y., an enterprise created at state expense. A feature of this canal was the construction of reservoirs on swamps which were found on the divide between the Chenango River and Oriskany Creek, and it is said that these reservoirs were the first of the kind constructed. The canal was constructed at the behest of political influence and never had enough gross income to pay operating expenses and repairs.

Mention may also be made of the fact that during the years following his construction of the American locomotive he was appointed to head three important state commissions. One gave consideration to the enlargement of the Erie canal, which had become badly congested in the eastern division. He favored an enlargement to a depth of eight feet. The legislature made it less and the canal commissioners were so extravagant in beginning the work that the scheme was delayed for years. A proposal to construct a canal from Oswego to the Hudson, which would accommodate Hudson river sloops, was investigated by Jervis and opposed. When the directors of the unfortunate Erie Railroad company applied to the legislature for permission to cross the Delaware into Pennsylvania, as a measure of economy in operation, as well as construction, a Jervis commission supported the measure and the permission was granted.

When the Croton aqueduct was constructed to supply New York City with water it was the greatest engineering work of the kind in the world. It was also an example of good work done under the continuous storm of unjust criticism. It is memorable here because it was the most impressive work designed and executed by John Bloomfield Jervis. Here is the story of it.

When the intelligent people of the town had so far overcome the inertia of the mass as to secure an appropriation for the enterprise, a commission was appointed to take charge of the work. The commission selected Maj. D. B. Douglass for chief engineer. The major was a graduate of Yale University and of the Military Academy at West Point. He had completed the latter course in two years. He was an able engineer. The annals show that he had that indefinable characteristic called culture, by inheritance, (if that be possible), and by life-long association with cultured people. His experience in the national army had given him what was called a "military bearing." His political party association had no influence upon his selection, but the commissioners belonged, of course, to the party in power.

When Douglass had completed his surveys for the location of the head of the aqueduct on the Croton River, he reported his choice to the commissioners. It happened that the commissioners had already decided that the head should be located at another point on the river. In the argument which followed the major naturally spoke with the bearing of one accustomed to command, and it is likely that he did not wholly conceal the contempt which he felt for one of the commissioners. The commissioners were not accustomed to such a bearing and the major was thrown out. They then invited John Bloomfield Jervis to take the vacant place. Jervis refused to do so until he was fully assured that Douglass had been definitely discharged. He was then well pleased to take over the work, for he fully understood the distinction that would come if he succeeded in constructing an aqueduct in every way suited to the needs of the city.

For eighteen years Jervis had been recalling the morning of April 10, in 1818, when several of his neighbors gathered near his home to jeer

him for his supposed effrontery in attempting the apprentice work of a civil engineer; now he was derided by the newspapers of the city for supposing he could create a water system that required the talents of the greatest engineer in the world—a man, withal, who had the instincts and culture of an artist. He was accused of having used underhand means to oust the major, who was said to be the only engineer in the country who was able to do the required work. It was also said that Jervis had played politics in order to get the position. Perhaps the attack that proved most painful was the assertion of a contributor to Hunt's Merchants' Magazine, who granted that Jervis might be able, through long experience on canals, to do the mere mechanical work of constructing the aqueduct, or underground conduit, but what was needed by the city was an engineer who could also, through a life-long association with people of culture, and a study of, and a consequent familiarity with Art, design the above-ground features of the system in a manner that would be a credit to the great city.

Spurred by injustice Jervis worked by day and planned by night. Surveys were made of every possible route from the Croton River to the city, and each route was resurveyed to make sure that no errors had been made, and that a full knowledge of the peculiarities of the line was fully set forth. As a reward for this intense care for the city's interest, he was assailed for wasting the city's time in order to prolong the time of his employment at a high rate of pay which he did not earn.

Finally he located the head of the aqueduct at the point which the commission had favored, and he was denounced as a mere tool of the commission, and an engineer utterly unfit to do even the "mechanical" part of the job. And then, to give his opponents what seemed to be a complete triumph, a deluge of rain came, when the dam in the river at the head of the tube had been almost completed, and washed a large part of the structure away.

A public investigation which sustained Jervis, was denounced by the editors as a predetermined plan to deceive the public, but the engineers, who examined the plats of the many surveys made, were fully convinced that the enterprise was in the right hands.

At the Harlem River crossing some of the editors declared that the people demanded an aqueduct structure while others thought a tube under the river the thing. Jervis made plans for both systems, with elaborate computations of every item of cost and the commissioners ordered the construction of the succession of stone arches called High Bridge.

The stone-walled reservoir in the Egyptian style, at 42nd street and Fifth avenue, must be mentioned for its beauty.

In 1842, after six years of incessant attack, the water was allowed to flow through and fill the aqueduct full.

Forty odd years after the aqueduct was opened a New York reporter asked the city engineer if any cracks had developed in it. He replied:

"A few."

"How did you discover them?"

"The patrolmen saw that the ground was moist where the cracks had developed."

"Then you had to dig down and put on a patch of concrete?"

"It was not quite as bad as that. We were not obliged to do so much as shut off the water. We dumped a few bushels of corn meal in at the head of the aqueduct. Enough of the meal was carried into the cracks to stop them effectually."

In the meantime Boston needed a similar supply of pure water and a committee of men able to pass upon the beauty as well as the quality of the work, was sent to inspect the city reservoir and High Bridge and the tube. This done they employed Jervis to construct their system. Boston was then, as the reader knows, the center of the nation's art and literature; and its enterprise in constructing railroads, to secure the trade of the western part of New York state, had made a successful start in the development of their city's growth through which a day came when by an actual count the number of new buildings there was almost exactly balanced by the number of "For Sale" and "To Let" signs displayed on the buildings of New York City.

New York had rested in contented ease through the belief that the "palatial" Hudson river steamers furnished a system of transportation superior to all others. The count of the "For Sale" signs caused an awakening. An enterprising merchant named James Boorman believed that a road along the bank of the Hudson could compete with the river steamers, and he persuaded Jervis to join him by making a survey as far as Poughkeepsie for which only \$1500 could be raised. A survey had been made by another engineer from Poughkeepsie to Albany. A consideration of the plats of the two surveys led Jervis to invest some of his savings as well as assume the responsibility of taking charge of the work.

Of the construction of the road no account need be given here except to note that it was more difficult than had been foreseen. That it was done in the best manner of the day is certain. The history of the road is chiefly interesting because of the diplomatic work done by Jervis.

When the directors of the company made their first application to the legislature for a charter they failed to get it because of the opposition of the directors of the Harlem road, the directors of the Western of Massachusetts, the river boatmen and the owners of the many fine estates along the east bank of the river. The estate owners were especially active in the matter because they believed that a railroad along the water's edge would ruin their homes.

At the next session of the legislature the directors placed the name of Jervis at the head of the number selected to make a new application for a charter, and gave him control of the proceedings. Jervis had never done any such work but when he appeared before the legislators at Albany, and met the lawyers and lobbyists serving the opposition, he arranged his statements of facts in such a succession that they reached a climax at the end of his argument just as a great novelist brings his story to a climax. He used an inborn talent and when the legislators had heard him, they brushed aside the polished subtleties of the lawyers,

and granted the charter. Later when armed guards were placed to keep his surveyors off their grounds, Jervis went to Albany and secured an act which gave the surveyors every needed facility.

One feature of his argument before the railroad committee is yet memorable. A lobbyist for the estate owners asked him for his candid opinion about the effect which "the foul-smelling, smoke-belching locomotives" would have upon the sale price of the beautiful homes that bordered the river. Jervis replied that when the owners of those homes sat on their verandas and, on looking down across the wide lawns, they saw on the river bank the swiftly-moving trains with the long, white plume of vapor trailing from each smokestack, they would admit that the scenery had been beautified by the construction of the railroad. It is said that the home owners groped in vain for words adequate to express their feelings, when they heard that statement. In time however, they saw that Jervis was right.

One may recall, too, the contacts which Jervis had with the contractors along the line, and the imported navvies whom they employed. Jervis served as peace maker between the contractors who through ignorance, took the work at less than cost. He persuaded the directors to raise the price to a point where the contractor could come out even because that would be cheaper than to allow him to abandon the job. He then helped the contractor in various ways so that a profit might be made. He was also peacemaker among the navvies. They belonged to different clans who had murderous feuds, one with another. Jervis showed sympathy with understanding for these men, and so was able to quell many, but by no means all, of the battles.

Most memorable of the characteristics of the man however was his loyalty to his employers. He not only did all the work of a chief engineer but he went out along the line, at times when he should have rested; and when there he assisted and encouraged the resident engineers in their work. He found for a time his recreation "in the cares, duties and results of his labors." He drove the work by day and moiled it over at night until the line was opened to Poughkeepsie. But his health then broke down because of continuous overwork. When Boorman, who had become his friend, saw the lagging muscles he protested and asked Jervis to suggest a line of easier work and less care. Jervis replied that if he could be made consulting engineer, with power to regulate the traffic as general superintendent, the pay hitherto given to be continued, he could earn his price and yet recover his health. The board of directors at that time consisted in part of ship owners. These merchants agreed that Jervis might be made consulting engineer, but as to his taking charge of the traffic, they supposed that as they had been in the transportation business for a good many years they were yet competent to attend to that without any aid from a civil engineer. Moreover they were of the opinion that a consulting engineer could not earn as much as a chief engineer in immediate charge of the work.

Jervis had also wanted a trip to Europe at the company's expense. This they would grant if the salary were reduced. Even Boorman thought

Jervis should not think of trying to handle the traffic. Accordingly Jervis resigned and went to England at his own expense; and he was cordially received by the engineers there because his fame had preceded him. Of his experiences there it need only be said here that he inspected the engineering works comprehensively and in detail. His health improved rapidly and in a way that showed he had been worn down as much, or more, by the cares of his position as by the exposure to storms and to the strain of overexertion. He returned greatly improved in health and ready for the next enterprise needing him. This enterprise was the reconstruction and expansion of a little line in Michigan, which had been constructed at the expense of the state, and had gone to ruin for want of efficient and honest management. Its name was the Michigan Southern.

In the period which ended in the panic of 1837, Michigan had sold bonds of a par value of \$5,000,000 and had received the "paper money" of a bank that was taken over by a receiver a short time later. A number of "internal improvements" had been begun by the state but only two of them need mention here. The Michigan Central Railroad had been constructed from Detroit as far as Kalamazoo, on the way to Lake Michigan, and the Michigan Southern had its rails laid from Monroe, at the head of Lake Erie, to Adrian. When the rails had been worn to a frazzle, and the tax payers had become weary of politician management, both roads were sold to eastern capitalists. George Bliss, a memorable builder of Springfield, Mass., was the leader of those who bought the Southern. John Stryker, of Rome, New York, a personal friend of Jervis, was another man of means in the transaction, and the two invited Jervis to join them, to take the post of chief engineer. He accepted and was soon made president of the company.

In the meantime a railroad had been constructed from Toledo toward the head of the Kalamazoo River. This company was consolidated with the Michigan Southern, and the eastern terminus was located at Toledo, instead of Monroe. This change was made because several roads had been chartered to construct lines from Buffalo to Cleveland, and thence to Toledo, and the work was so well under way that it was easy to see that an all-rail line would soon connect Toledo with New York City.

Another corporation had been chartered to construct a line across the north end of Indiana. It was named Northern Indiana and it was secured under interesting conditions. Both the Michigan Southern and the Michigan Central, as projected, were to end on the east shore of Lake Michigan, and such traffic as might develop west of those points was to be brought across the lake with steamboats. The Northern Indiana charter, (no rails had been laid), was offered to the Michigan Central people on the plea that it would enable them to cross the northwest corner of Indiana and so to enter Chicago. John W. Brooks, the chief engineer, and James F. Joy, the attorney, thought the price, (\$50,000), fair. Joy went to Boston to present the matter to the President and Board of Directors of the company. John Murray Forbes, then famous as a merchant and diplomat, and later, as a railroad builder, was president. The

directors were business men of note. They listened with interest to Joy's statement of the legal aspect of the case, but when he presented a letter from Brooks which declared that Chicago would have a population of 200,000 within twenty years, some of the directors left the room in disgust and all rejected the proposition.

The Michigan Southern people then bought the charter and elected Jervis president of the two corporations. He was able to raise the money for beginning the new construction, as well as for the reconstruction of the old track, which had gone to ruin under the management of the politicians. He was then (1850), 55 years old which, in those days, was a period when most successful business men began to think of retiring. Jervis thought only of the work of running trains through from New York to Chicago, by way of the tracks which he had in hand; for he was the chief engineer as well as the president of the consolidated line. What he did to prepare for those through trains was described in part in a report:

"In the space of twenty months, including two winters, one of which was especially severe, the Michigan Southern built 160 miles of new road laying T rails, and rebuilt 80 miles of old road, laying T rails. During the whole progress of the work the company encountered an active hostility which was directed against their securities, discrediting their finances, and, so far as possible, impairing the confidence of those engaged in the work. It is sufficient at this time to say that all obstacles were surmounted, active progress maintained, and the work brought into use with unprecedented rapidity."

In the course of twenty-six consecutive days, (excepting Sundays), Jervis built, complete for traffic, forty miles of new railroad. The Michigan Southern was opened for traffic from Chicago to the East on May 22, 1852, but the road east of Toledo was not then quite ready. It was when he was constructing this line of road to Chicago, under adverse conditions, that John Bloomfield Jervis acquired a reputation that brought him from retirement, later, to share in the honor due to the rebuilders of a wreck, for the benefit of share owners who were helpless without such aid as was then given them—as shall appear.

It is further to be noted that Jervis showed himself to be a great president of railroads as well as a civil engineer. While he was constructing the Michigan Southern with unexampled speed the Boston people came to realize that they must get into Chicago, and when they asked their lawyer how to do it, he told them that the charter of the Northern Indiana, which they had rejected contemptuously, gave their competitors an exclusive right for ten years to the territory needed. Undismayed they sent Lawyer Joy to Indianapolis to procure a charter for a new road, regardless of the conditions, but he was confronted with a statement of the rights of the Northern Indiana, as prepared under the direction of President Jervis, which the legislature could not evade.

But luck favored the lobbyist. A corporation had built a short line, (20 miles), from the Ohio river northerly, and had not been able to make any profit from it. Their charter, however, was a roving commission, so

to say. They were allowed to extend their line at any time, in any direction, and to any distance; and what was of distinct importance in this case, they were allowed to commence construction at any point on a proposed extension. Being anxious to sell out, these railroad owners showed Lawyer Joy their charter, convinced him that it would permit him to build an extension to the southern line of Michigan and to the eastern line of Illinois, and begin work at both state lines at once. Of course Joy bought the charter. The total cost of this deal was \$500,000, in place of the \$50,000 at which the corporation might have had the Northern Indiana, but they were glad to get into Chicago, then, at any price.

This *coup* greatly chagrined Jervis—so much so that he did not mention it in any of his writings now obtainable; for it enabled the Michigan Central to enter Chicago on the tracks of the Illinois Central one day ahead of the Michigan Southern. It may therefore be noted here, once more, that while Brooks won the race, Jervis by his tremendous labors, won a higher standing for efficiency among the other civil engineers—J. Edgar Thomson, President of the Pennsylvania Railroad Company, being one of those who showed special interest in work done by Jervis.

As a matter of fact, the Michigan Southern entered Chicago on the track of another corporation, the history of which must have some attention here, because Jervis was its president. In 1846 Judge James Grant of Davenport, Iowa, with seven other small capitalists, obtained a charter from the Illinois legislature which permitted them to construct a railroad from the village of Rock Island, on the east bank of the Mississippi, to "the Illinois river at the termination of the Illinois & Michigan canal." The charter was amended, later, to permit entry into Chicago.

The promoters of this line had no hope of constructing it with local capital. They intended to sell the charter to the capitalists from the East who were coming west to buy just such charters. Accordingly when the Michigan Southern company was well on its way to Chicago, so to say, Grant offered his charter to its board of directors, and President Jervis. A contract was made and when the company was reorganised Jervis was made president. A contract for the construction of the whole line was made with Henry Farnam and Edwin C. Litchfield, both well-known railroad builders. Jervis was not enthusiastic over the plan of giving the building into the hands of one firm but the two contractors were willing to take bonds and stock for their pay, with only \$500,000 in cash, and there was no better way of providing for construction. The track was built without ballast in any quantity worth mention, and where there was no need for building embankments, or cutting through ridges, the ties were laid on the native sod. But all the work was done according to specifications and Jervis was obliged, of course, to certify that it had been thus completed.

The actual work on the Rock Island Railroad was begun on April 10, 1852; the road was opened for traffic on February 20, 1854. The contractors received \$2,000,000 in 7% bonds; \$500,000 in cash, payable

in monthly installments of \$25,000 each, and \$1,487,688 in shares of the stock taken at par and to be delivered when the road was completed. The length of the road was 181 miles. It was a profitable contract for the two partners; or at any rate they held a controlling interest in the stock after the accounts were settled, and Farnam was then elected president in place of Jervis; for Jervis's views of management did not please the new board of directors. And that is a matter for consideration here.

Jervis had designed a new box car which weighed but six tons, where all others in use on other roads weighed on the average ten tons; and yet the Jervis design carried the usual cargo of the day, which was ten tons. Jervis told the directors that twenty-ton locomotives were more than twice as heavy as the track could endure for any length of time, and advised the purchase of those weighing less than ten tons. The directors jeered at the idea of using the light locomotives. His views in other matters of management were also more or less opposed. Here is the explanation:

Jervis wished to build up the road as a profitable means of transportation. The directors wanted to build up the price of the stock on the New York market, and they believed that using rolling stock best suited for the track would give it a bad reputation with stock buyers. So Jervis, after a patient argument resigned as a director and as chief engineer.

In the meantime, however, he had served a company, organized by Farnam, to build a bridge across the Mississippi, from Rock Island to Davenport, as Consulting Engineer, and the bridge was erected. It was the first bridge to cross the Mississippi but it is of more interest, perhaps, because it was designed to make the Rock Island a first link in a road from Chicago to the Pacific. In spite of his efforts to raise the price of Rock Island stock on the market, instead of working to make the road a profitable system of transportation, Farnam was a man of vision. While he kept the workmen busy creating the track from Chicago to the Mississippi he kept in mind the talk about a line across the wild lands between the Mississippi River and the Rocky Mountains; and the still wilder and more desolate canyons and upheavals of rocks, and the waterless deserts known to exist between the plains and the waters of the Sacramento River. Visionaries had made plans and a chaotic congress had discussed routes for such a railroad. Farnam was the first to begin to build a railroad west of the Mississippi, and he was able to raise funds for it because his line was expected to become a part of a transcontinental system. He first chartered a company to bridge the Mississippi and then another one to extend the Rock Island, which was thus provided for, to Iowa City, 66 miles, on the way to Council Bluffs, on the east bank of the Missouri River.

The story of this railroad is no part of the biography of John Bloomfield Jervis. The story of the bridge is of interest here because Jervis was, as noted, the consulting engineer in its construction, and because he was a witness in a succession of law suits brought to have the bridge removed as an obstruction and a nuisance to the traffic on the Mississippi.

The village of Rock Island got its name from a rocky island that lay

almost against the east bank of the river. The island was a government reservation, and an arsenal with other buildings had been erected on it. The Illinois charter of the railroad company permitted it to build its track to the west line of the state. The Iowa charter of the bridge company permitted it to build a bridge to the east line of the state. The two charters covered the construction of a bridge across the Mississippi after Farnam secured from the War Department a permit to build a trestle across Rock Island. He did not apply to Congress for a permit to build across the Mississippi. No one interfered when he built a bridge and trestle from the Illinois shore to the west edge of an abutment on the west side of Rock Island. He then built a draw bridge that gave a passageway 125 feet wide through the bridge, and five spans, each 250 feet long, that completed the bridge to the Iowa shore. This bridge was approved by Consulting Engineer Jervis.

The river navigators and the St. Louis Chamber of Commerce finally began a series of appeals to the courts to oust the bridge as a nuisance to the river traffic. Confessedly the bridge did obstruct that traffic to a considerable extent, but this was not the first bridge to obstruct traffic in streams that were under the jurisdiction of Congress. Abraham Lincoln was one of the attorneys for the bridge company and he stated the case in a few words: Had the people as much right to cross the river as to travel up and down it? Another writer said that the traffic of the bridge was of much more importance to the people of the nation than the traffic on the river at that point. This was the view of Consulting Engineer Jervis.

Finding they were making little headway in the courts, the river people, as both Jervis and Lincoln declared, burned the east span of the bridge. A steamboat was taken from its route on the river below St. Louis and sent up through the bridge. After passing the draw one of the wheels was stopped and the other was kept revolving. This drifted the boat against the pier or abutment on the east side of the draw and there it lodged. After the spectators had satisfied their curiosity and had gone away, it was seen that the boat was burning and it was consumed. So was the adjoining bridge span. The owners of the boat brought suit for their loss on the ground that the bridge was a nuisance and had caused the fire by upsetting a stove in the cabin. After years of trouble the railroad company won all the suits.

In the spring of 1858 Jervis saw that his "plan of management could not prevail" with the board of directors of the Chicago & Rock Island Railroad Company, and he therefore resigned. For just forty years he had devoted his time to the service of the American people as a civil engineer. Because he had realized that "a good name is to be chosen rather than great riches," and because he had found recreation in the cares, duties and results of his profession, he had risen to the top rank. But he was 63 years old, and physically worn because of many days and nights of overwork. He had never speculated, taking advantage of the knowledge obtained by his work to buy stocks selling at low prices, but he had by a frugal life been able to save enough from his

salary for a competency, and he was glad to return to his old home to rest in peace.

Of course he could not settle down to a life of idleness. Furthermore he had seen the results of mismanagement of railroads to an extent that made him wish to warn the unwary capitalist against the evils that would lead to loss. In fact he had read in an editorial in Hunt's "Merchants' Magazine" a statement declaring that the builders had invested \$1,200,000,000 in the railroads of the country and that they had received a return of less than one percent. Accordingly he wrote, in 1859, a volume entitled "Railway Property" which was the first in this country to give adequate instruction to capitalists as well as young engineers. Copies of this book were sent to some of his intimate friends among whom the one best known now was Samuel J. Tilden.

While he had thus definitely retired from the active work of the civil engineer, the most memorable task of his life, and the one that gave him the greatest satisfaction, was yet to be done. In the period during which the Pennsylvania Railroad was constructed from Harrisburg to Pittsburgh, by John Edgar Thomson, and while Jervis was building the Hudson River Railroad, a line of railroads that extended the Pennsylvania Railroad from Pittsburgh to Chicago, was commenced. The Ohio & Pennsylvania was chartered in Ohio on February 24, 1848. It was to extend from Alleghany City, Pa., to Crestline, Ohio. The corporation was aided by the Pennsylvania and it proved profitable. Because it was profitable another corporation was created to extend it to Ft. Wayne, Indiana. The charter was issued in Ohio in March, 1850, and in Indiana in January, 1851. The builders based their hope of success chiefly on the fact that it was also an extension of the Pennsylvania, but they expected much traffic from the Wabash canal, in Indiana, the summit level of which was at Ft. Wayne. A year later, September, 1852, an Indiana charter was secured to extend this line to Chicago.

Although this last road had for its chief engineer Jesse L. Williams, one of the most efficient men of the period, it was impossible to raise the funds to complete it. Such traffic as was obtained did not pay the interest on the bonds or even for maintenance of the road. The road from Crestline to Ft. Wayne was also unable to earn expenses. President Thomson, persuaded the boards of directors to consolidate the three railroads named under the name of Pittsburgh, Ft. Wayne & Chicago, but the new company was unable to market its bonds. The affairs went from bad to worse until the rails were worn to a frazzle, the rolling stock was badly debilitated and the pay of the men was in arrears.

It is now to be recalled that the stock of the two roads west of Crestline, Ohio, had been taken to a large extent along the line, and this was done, too, where the land was covered with a great forest. Oaks, hard maple, hickory and elm were important varieties of trees. The farmers had come to the region because land was cheap. The whole of Van Wert County, Ohio, was assessed at \$1.37 per acre before the railroad was constructed, and that including the villages and the lands along the Maumee canal. The land was fertile; crops of from 80 to 100 bushels of

corn were raised on measured acres, when the agricultural societies offered prizes for special cultivation. But in the early days the farm owners lived in log cabins, and the land was cleared of the forest growth by girdling the trees and chopping down the undergrowth. When the family came out of the cabin, in winter or in summer, they gazed upon a "deadening"—a five-acre area of land, or more, covered with dead trunks of trees which spread broken limbs before heaven as if in protest against the treatment they had received. The most depressing scenery found in the nation was that of the "deadening" in Western Ohio and Northern Indiana.

When the promoters of the road from Ft. Wayne to Chicago went to the owners of those lands and asked for subscriptions to the stock they were received in kindly manner. These farmers did not often see fifty dollars of their own in cash in any one year while the "deadening" was in existence, but they bought shares of railroad stock; they paid for them first of all with labor. Men who shivered with chills in the forenoon, and were parched with fever in the afternoon, helped to prepare the way for the rails which they also helped to lay. More interesting still, (it was the most memorable contribution of all that was made in the expansion of the American railway system), they paid with their land. They not only traded the right of way for shares; in many cases they gave it outright; and then they bought shares with land that could be sold for cash after the railroad was open for traffic. They gave so much land in exchange for shares that the company was able to borrow \$1,000,000 upon it as security. Can the reader imagine the feelings of those land owners when they learned that the road had gone into the hands of receivers, and that their shares were worthless, with the accompanying statement that the construction of the road had been postponed indefinitely?

Happily there were three men in the East who could understand the trouble of the men of the "deadening." One was James F. D. Lanier, the wheel-horse of the banking team, (so to say), of Winslow, Lanier & Co. Lanier had lived in Indiana and was personally acquainted with men who had made the "deadening." He had gone to New York and was the first banker to make a market for western railroad bonds. He had not sold any of the stock of the lines west of Pittsburgh that are here under consideration but he had sold the underlying bonds of all three. He was the J. P. Morgan of his day in that he would do everything, within the law and right dealings, to protect those who had bought bonds from him; and what is most interesting to this account, he would do everything thus possible to protect the interests of all the other security owners.

When the Pittsburgh, Ft. Wayne & Chicago Railway was put into the hands of receivers it was entirely lawful to foreclose the mortgages and sell the road for the benefit of the underlying securities. But Lanier would not do this. He consulted with President Thomson, of the Pennsylvania Railroad Company because of the interest of that corporation in the well-being of the lines extending it to Chicago. He also consulted with Samuel J. Tilden, the foremost railroad lawyer of the period.

The three saw that it might be possible to resuscitate the morbiund line and save all the interests from loss; and they made a plan by which they would try to do so.

When a meeting of the owners of the underlying securities was then called, Lanier told them plainly that they had the legal right to foreclose and buy in the line at a price far below value, and then he proposed that a committee be appointed to foreclose and handle the whole matter in the interest of all concerned.

One heard much in Congress about the greed and dishonesty of "Wall Street," then, but the truth is that the percentage of dishonest men among congressmen was far greater than that among the financiers of the metropolis. When James F. D. Lanier made a plea for the interests of the share owners who lived in the "deadening" of Ohio and Indiana, the owners of the underlying bonds instantly responded. Lanier, Thomson and Tilden were appointed a committee to do the work of rejuvenating the wreck.

"You need an engineer." That was the dominant thought in the minds of the committee when they came into power. They needed the most efficient engineer in the nation, and Thomson, who was the most efficient railroad manager in the nation, knew where to find the man. For, as said, he had looked on while Jervis drove the work of rejuvenating the wrecked Michigan Southern and extending it into Chicago. Thomson had recognized the master mind then, regardless of the arrival of the Michigan Central in the growing terminal city a day ahead.

Jervis had retired; he had no need to go forth from a cherished home. But he had seen the men of the "deadening" in their homes, and when this committee asked him to take full charge of the road as general manager, he received their call as the command of duty "because the stock and floating debt were very honorably provided for." In December, 1861, forty-four years from the time he began the study of two books devoted to the arts of the surveyor—study by the light of a tallow candle—"the Master of all good workmen" set him his task anew.

The school boys in Van Wert, Ohio, in those days, used to stop beside the track of the Pittsburgh, Ft. Wayne & Chicago railroad, when a train was coming, in order to see the water spurt from under the ends of the ties when the locomotive passed over them. The boys also discussed hopefully the possibility of a wreck, for many of the ties were rotten, and many rail ends were crushed into strands. The writer of this sketch was one of those boys.

As General Manager, Jervis was in charge of the line as Chief Engineer, but it was also his duty to create traffic—create because it is very difficult to take it from established routes. One finds little in the annals to tell how he handled the traffic but it is seen that, first of all, he went among the disgruntled employes and by candid explanations showed them the outlook for the road. The arrears of wages were paid with money loaned by Lanier who charged the company common interest only for the loan. More important still, in restoring the morals of the men when Jervis went among them as they rebuilt the track he discussed

with them the best means to be used. He could, and on occasion he did show them how to do needed work, but at all times he treated them as men who were able, and as willing as he was, to make that track as good as the best in the nation, if not a little better. They very quickly came to realize that while he was their leader they were his *associates* in the most laudable work done on railroads in the period before the Civil War. There was no greasy familiarity nor any ostentatious assumption of dignity in the bearing of John Bloomfield Jervis when he met his men, and their response helped to build the traffic as well as the track.

At the end of his first year the committee reported that they had expected much from the General Manager, and they had received what they expected—they “had made no mistake” in choosing him. An ample profit had been made and plowed in. In a little more than two years from the day that Jervis entered the committee’s employ, they declared a well-earned dividend of twelve percent on the common stock which had been issued for the old stock that had been wiped out by the foreclosure of the mortgages.

Jervis says in his autobiography that the rate of the dividend was ten percent, but this rate is stated because a stock dividend had been declared. The rate was twelve percent on the original shares of which the men, who lived in the desolation of “deadening,” had purchased a considerable number. Worthless stock had now become a good “business man’s investment.” The rejuvenation of the Pittsburgh, Ft. Wayne & Chicago Railroad was accomplished in a little more than two years.

When this work was done Jervis returned to his home, well worn, but he was occupying a position which had never been reached in the engineering profession by any other man in Europe or America; for he was *beyond question* the leader. He was retained in the service of the company he had revived as a Consulting Engineer for several years.

From 1818 to 1863 John Bloomfield Jervis was almost continuously serving his country by developing the systems of transportation; for the two water-supply systems which he created for the two cities may be considered as systems of transportation. During that period if one may restate the facts, he was the chief engineer of eleven great enterprises—really great for the day in which each was constructed. He carried the title of president in three of the railroad companies with which he served; he was general superintendent of one canal and one railroad, and consulting engineer of two railroads. His most important inventions were the locomotive “Brother Jonathan” and the light-weight freight car. Perhaps his forked bridge, constructed at Alleghany City, a wonder in its day, should be added to the number of his inventions, for there were features which might have been patented. It should also again be noted that he was at the head of three very important New York state commissions appointed for the consideration of transportation enterprises.

Of the really important engineering enterprises of his period of service, Jervis was at the head of just about three times as many as were given to any other engineer.

The final service rendered the public was the presentation of \$50,000 to his home town for the creation of a public library.

In those years of the railroad era during which John Bloomfield Jervis served his country, it was the custom of the people to speak of the canals and the railroads as "works". Both as a verb and a noun, *work* was the most important word in the lexicon of the builders of our nation's civilization, and no man of all the builders comprehended the import of it more fully than Jervis. It was through work, begun after he had passed beyond the usual age of self-reliant enterprise, that he came to see the first glimmer of stimulating ambition. Work brought him opportunity. It brought into activity his latent powers and nourished their development. Work well and faithfully done, gave him the distinction he sought, and the memory of it made bright the days when, because of old age, he could work no more. No man of his period enjoyed life more than he did and few enjoyed it as much.

He fell asleep, without fear and without pain, on January 12, 1885. On a gentle slope in the Rome cemetery, where spruce cast their shade on the lawn and other beautiful trees are close at hand, there is a tall, gray-granite shaft that attracts the eye because of its perfect proportions; and on the side of the base which faces the driveway one sees this:

JOHN BLOOMFIELD JERVIS

CIVIL ENGINEER

An Early Plea for The Railroads

No one familiar with the work of sorting and classifying the hundreds of early railroad schemes and projects, ranging from sober common sense to the wildest gift of the imagination, can but appreciate that human nature, so far as the gaining of wealth is concerned, has advanced but little. The majority of these were scarce worth the paper upon which they were printed, on the other hand, some of these proposals were advanced by men of sound common sense who were far in advance of their times.

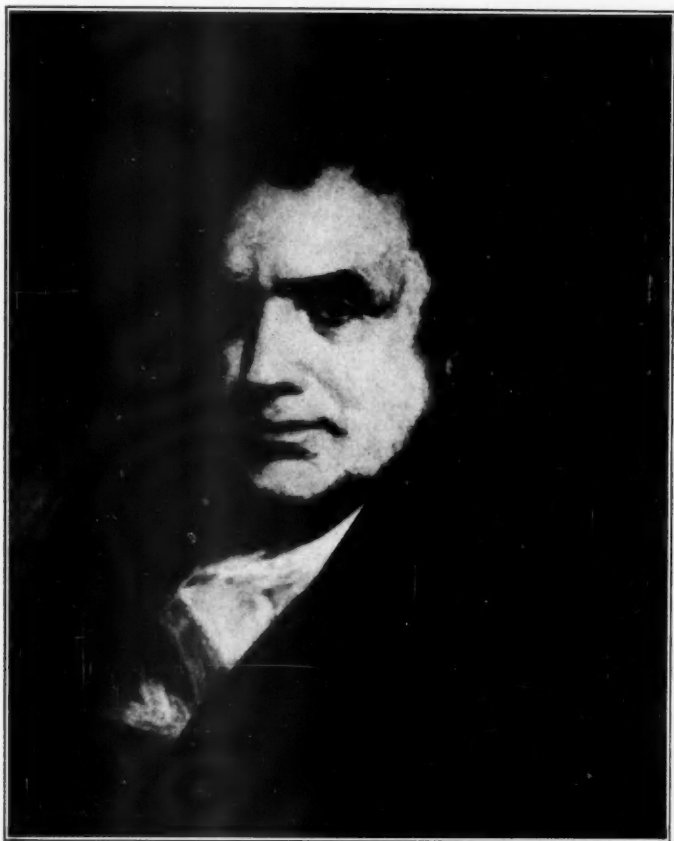
In this latter class belongs Mathew Carey. Born in Ireland, Jan. 28, 1760, he afterwards came to this country and settled down in Philadelphia. He became a prose writer and publisher. The best known of his political writings was his "Olive Branch" (1814), an effort to promote harmony among the political parties during the War of 1812. It passed through ten editions. His other two best known works are "Irish Vindications" (1819) and "Essays on Political Economy" (1822). He died in Philadelphia, Sept. 16, 1839.

Carey was prone to sign by a nom de plume, usually a different one for each article, using a name that struck his fancy. In one instance the Philadelphia newspaper marked the arrival with mail from Liverpool of the "new ship Algonquin" and the same week appeared a contribution on the Anthracite Region of Pennsylvania with the name "Algonquin" appended. Other names he used were "Fulton", "Hamilton" and "M. C." He was a born pamphleteer and wrote well on whatever theme caught his attention for he was a man of great ability.

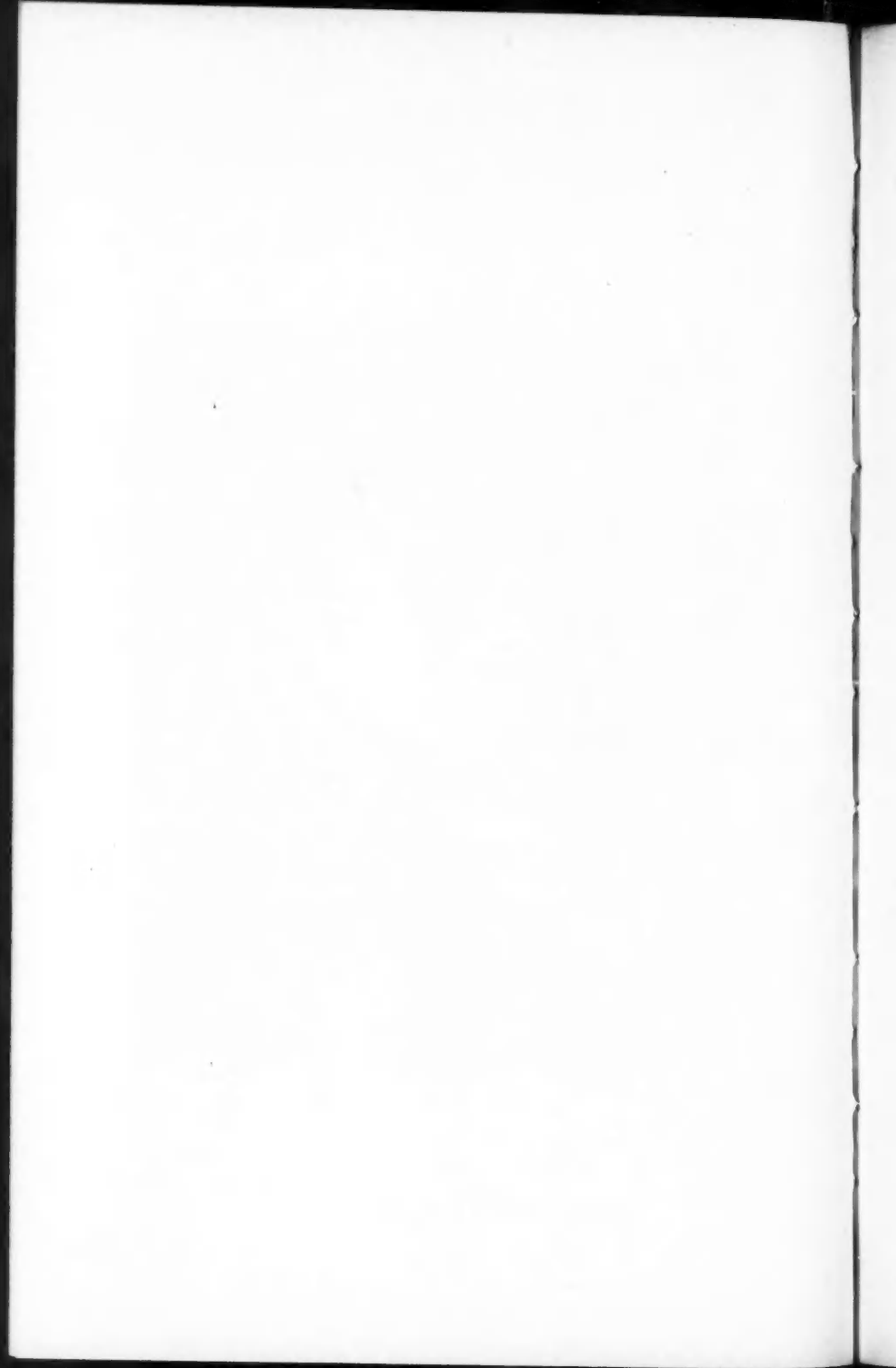
To the members of this Society his railroad articles are of the most interest and value. On reading the following, you will see that as early as 1827, he proposed a railroad on a route taken later by the Camden & Amboy R. R. You will also note he advocates the building of the Philadelphia & Columbia R. R. You will note his sound judgment and his reasons for selecting this route, and although in advance of the times, his advocacy was well grounded. Here we have one of the earliest pleas for a railroad, soberly set forth by a competent reasoner.—(EDITOR).

RAIL-ROADS

About two years since, the subject of rail-roads attracted a great share of public attention in this city. They were advocated as a means of general communication, calculated, according to some of their supporters, to supersede canals altogether, as combining various advantages of which the latter are not susceptible. Three prominent ones were insisted on—



MATHEW CAREY, 1760-1839



1. That rail-roads can be employed throughout the year, whereas canals are rendered useless during the prevalence of frost.

2. That the cost of railroads is not more than half, or one-third, or one fourth, or even, according to some English writers, one-fifth of that of canals.*

3. That rail-roads are practicable in various situations, in which, from scarcity of water, and other disadvantageous localities, it is impossible to construct canals.

The statements of the comparative expense of canals and rail-roads were taken from various English publications, and were very incorrect. It may be proper to trace the source from whence arose the delusion on this subject, for delusion it assuredly was in England. It is well known that the year 1825 was in that country an era of most extravagant speculation, only exceeded by that of the South Sea bubble. There were no less than 276 joint-stock companies projected in that year, of which the capitals amounted to £174,214,000 sterling, equal to \$783,000,000. And such was the superabundance of money—such the prevailing cupidity and cullibility of the public, that subscribers were found for all of them, however absurd or ridiculous. In most cases, a first instalment was paid, and in some, two or three, the whole of which were swallowed up by the projectors, who, in addition, frequently sold out their shares of the stock at great advances.†

Among these projects, rail-roads made a distinguished figure. By a list now before me, it appears that there were no less than 66 of them contemplated. Of thirty, the capitals amounted to £19,905,670 = \$89,000,000. Of the remaining thirty-six, the capitals were estimated at half as much, making a total of nearly £30,000,000 = \$135,000,000. Some of them were proposed to connect places, between which there was so little traffic, that had they been completed, the stock would probably not have yielded above one per cent.

* "A railway costs only about *three times as much as a turnpike—and a canal nine times!*"—Gray on Railways, page 206.

"In general the formation of a canal costs about *three times as much as a railway.*"—Wood on Railways.

"Railways may be constructed at a *fifth part of the expense of canals.*"—Appendix to Gray's Essay, page 181.

"A railway can, according to circumstances, be made at from a *half to a fourth of the expense of a canal.*"—Jessup in Gray's work, page 104.

† "Fraudulent Companies.—We are assured, on very good authority, that there are Companies, the shares of which are on daily sale in the Stock Exchange, to which not one-fourth part of the capital has been subscribed, or the deposit paid up at the banker's; that the remaining shares are held nominally by individuals denominating themselves projectors, contractors, trustees, directors, and auditors, who are unable to make any deposits upon them unless they first succeed in inducing the public to purchase them at a premium. Some of them who hold three thousand, four thousand, or five thousand shares, calculating that the premium is already their own, have set up handsome equipages, and embarked in a splendid style of living proportionate to the fortunes of which they believe themselves possessed. There are even well-authenticated cases, wherein the money raised on the shares subscribed for by the public, has been employed in the market by the directors to raise their value, so that no balance whatever has been left in the hands of the bankers to carry on the business of the company."—*Scotsman*.

In order to allure the public with the hopes of large dividends, it was found necessary to reduce the estimates of the expenses—and accordingly comparisons were instituted between canals of the largest dimensions and the greatest cost, and rail-roads of the minimum cost. Hence a case appeared to be made out, of the small comparative expense of the latter. Many of the projectors were iron masters, who calculated on a vast increase of profits, from the extraordinary consumption and increased price of iron. Within nine months, in 1825, the price of this article rose, in consequence, nearly 80 per cent. from £7 10s. to £13.

Some cautious persons here, doubting the accuracy of these estimates, and apprehensive that the public might be led astray by them, and thus the spirit of internal improvement, which was then excited in favour of canals, be distracted between the two objects, and a triumph be afforded to those opposed to the system altogether; they instituted a comparison between the expense of a rail-road, with a double set of tracks, as stated by Mr. Strickland, and the cost of our canals, which was the only fair mode of testing these estimates. The result of the examination was a decided conviction that they were very erroneous, that that there was reason to believe that the expense of the two modes of communication was not materially different, even at the actual expense of canals at that time, which was nearly 30 per cent. higher than they are contracted for at present. The article of expense, however, was not a material objection, provided a rail-road for general transportation was really practicable.

This was doubted—and the doubt was then not unreasonable—as the detection of so many errors or misrepresentations, on the part of the English projectors, in regard to the expense of rail-roads, proved that all their statements ought to be received with caution. This caution and these doubts were the more rational, as Tredgold, himself among the advocates of rail-roads, who wrote early in 1825, acknowledged that the Surrey rail-road, of about 18 miles, which had been in operation for about 20 years, and was almost the only one then in use for general transportation, had not succeeded so far as to induce the example to be followed. These considerations abated the zeal for rail-roads at the period, the public sentiment settling down in the conviction, that every consideration of prudence recommended to await the result of the experiments that were proposed in England, before we abandoned or suspended the canal system, of the salutary effects of which we had proofs before our eyes, in the Hudson and Erie and the Champlain canals. It now appears clear that the cause of rail-roads suffered extremely from the imprudent zeal of their advocates.

The rail-road from Manchester to Liverpool, a magnificent undertaking, is, however, in progress, and will be completed. There are few places in any country, where a rail-road is more necessary—as the canal is inadequate to the expeditious and regular transportation of the immense mass of merchandize that is to be conveyed to and from Manchester and Liverpool, so that frequently the most injurious delays take

place. A member of the British parliament, in the debate on the bill for incorporating the company which has undertaken that road, asserted that it sometimes happened that goods were as long on the way from Manchester to Liverpool as from the latter port to New York—and the assertion remained uncontradicted. Moreover, the navigation of the river Mersey, which forms part of the line for some miles, is attended with danger, and sometimes with loss.

Since the discussions took place in this city on the subject of rail-roads, two have been constructed in this country, which, although private property and for the use of the proprietors alone, have removed many of the doubts of the practicability of rail-roads for general purposes. I do not assert positively, although I am strongly inclined to believe, that they fully establish this all-important point. But this much at least is certain, that they not only justify, but appear to require a fair experiment to be made. The two rail-roads in question are those at Quincy, in Massachusetts, and at Mauch Chunk, in this state.

The Quincy rail-road is three miles long. It is used for the purpose of conveying immense blocks of granite from the quarries to a landing. The sleepers are composed of blocks of that stone, weighing from 15 cwt. to a ton—7½ feet long—and in thickness, 12 inches by 10. They are eight feet apart. The rails are of pine, 12 inches deep, and 6 wide, with a covering of oak three inches wide, and two inches thick. Plates of iron are attached to the oak 3/8 of an inch thick, and two and a half inches wide. Two horses only are employed, each of which draws two cars. They travel with the loaded cars at the rate of three miles an hour. The load of each car is from four to five tons. Each horse makes two trips per day. Thus the two horses draw, on four cars, with ease, from 32 to 40 tons per day. The stone is placed on a platform under the axles of the car, or, if very large, is slung in chains. Some blocks, weighing from eight to nine tons, have been conveyed in this manner. The wheels of the cars are six feet in diameter, shod with iron, half an inch thick, with a flange on the inner side of the rim to prevent the wheels from passing over the rail.

This road has satisfactorily established the grand point, that neither frost nor ice interferes with the use of rail-roads. During the whole of last winter, even after the heaviest falls of snow, the transportation was never obstructed. Immediately after the first fall of snow, two pieces of plank are placed between the foremost car and the horse. They meet in an angle at the centre, and being drawn along the rails, clear away the snow. This is an object of incalculable importance in countries where rivers and canals are locked up four or five months in the year, particularly in that season when it best suits the farmer to transport his produce to market: and in the event of rail-roads being found practicable for general conveyance, will give them in such countries a decided advantage over canals.

An experiment has been tried to ascertain the extent of the powers of a single horse. He drew with ease three cars, each weighing from 30 to 35 cwt. and loaded with about sixteen tons of stone. Twenty persons were mounted on the cars.

By the old road one horse conveyed only a ton and a half per day from the coal field—at present each horse conveys nearly six tons.

On the subject of expense, there is at present great uncertainty—but whatever it may be, the advantages are sufficient to countervail them. I will assume \$20,000 for a complete rail-road, with a double set of tracks, which are indispensable. The Baltimore committee on the Chesapeake and Ohio rail-road, have predicated their calculations of 250 miles at that rate, making \$5,000,000 for the whole. This is probably the maximum, and is therefore safe ground. The Quincy rail-road cost above \$11,000 per mile.

The Mauch Chunk rail-road is nine miles long, and lies on the side of a very precipitous hill. The summit level is about 930 feet above the Lehigh. The upper part of the chute, which terminates the road, is 215 above that river—so that the rail-road rises above 700 feet. Eight miles of the road are an acclivity to the summit level, and one mile a declivity on the other side. From the time of laying the first rail till the completion of the whole, was only two months and two days—a most extraordinary instance of dispatch for a private company.

The sleepers are of timber—four feet apart. The rails are likewise of timber, four inches by six, covered with a plate of iron, three-eighths of an inch thick, and two and a half inches wide. The cars weigh about 1500 pounds each—and the wheels are two and a half feet diameter. Twelve cars are generally attached together; carry each a ton and a half of coal; descend by the force of gravity; and are governed by one man, who, by a lever, can in a moment arrest them in mid career. There are at present 100 cars in use. Three horses draw up the empty cars, and are driven down by boys to resume their up-hill task.

The writer of this paper recently ascended in one of the pleasure cars, at the rate of three miles an hour. In this trip, one horse drew up two pleasure cars—and two horses were employed to draw up four others. On the return, the whole six, containing forty-two ladies and gentlemen, were attached together, and descended without a horse, at the rate of ten or twelve miles an hour. A small part of the road was passed at the rate of three minutes to a mile.

Previous to undertaking the rail-road at Mauch Chunk, seven miles of the distance were turnpiked. The expense of making the other two miles, and placing the rails on the whole, averaged about \$8000 per mile. If we estimate the expense of turnpiking the seven miles at \$2000 per mile, the whole cost will be about \$40,000, or nearly \$4500 per mile.

In trying a first experiment in this country, of a rail-road for general purposes, three points appear to require attention. First; It would be advisable to commence with a route of moderate length; secondly, with moderate ascents and descents; and thirdly, in a quarter where the traffic is very considerable. In glancing round, there is scarcely any district to be found which unites those three requisites so completely as the route from the Delaware to the Raritan, to commence at Bordentown or Burlington, and terminate at Brunswick, Amboy, or Washington. If a rail-road, for general transportation, can succeed anywhere, it must in this quarter.

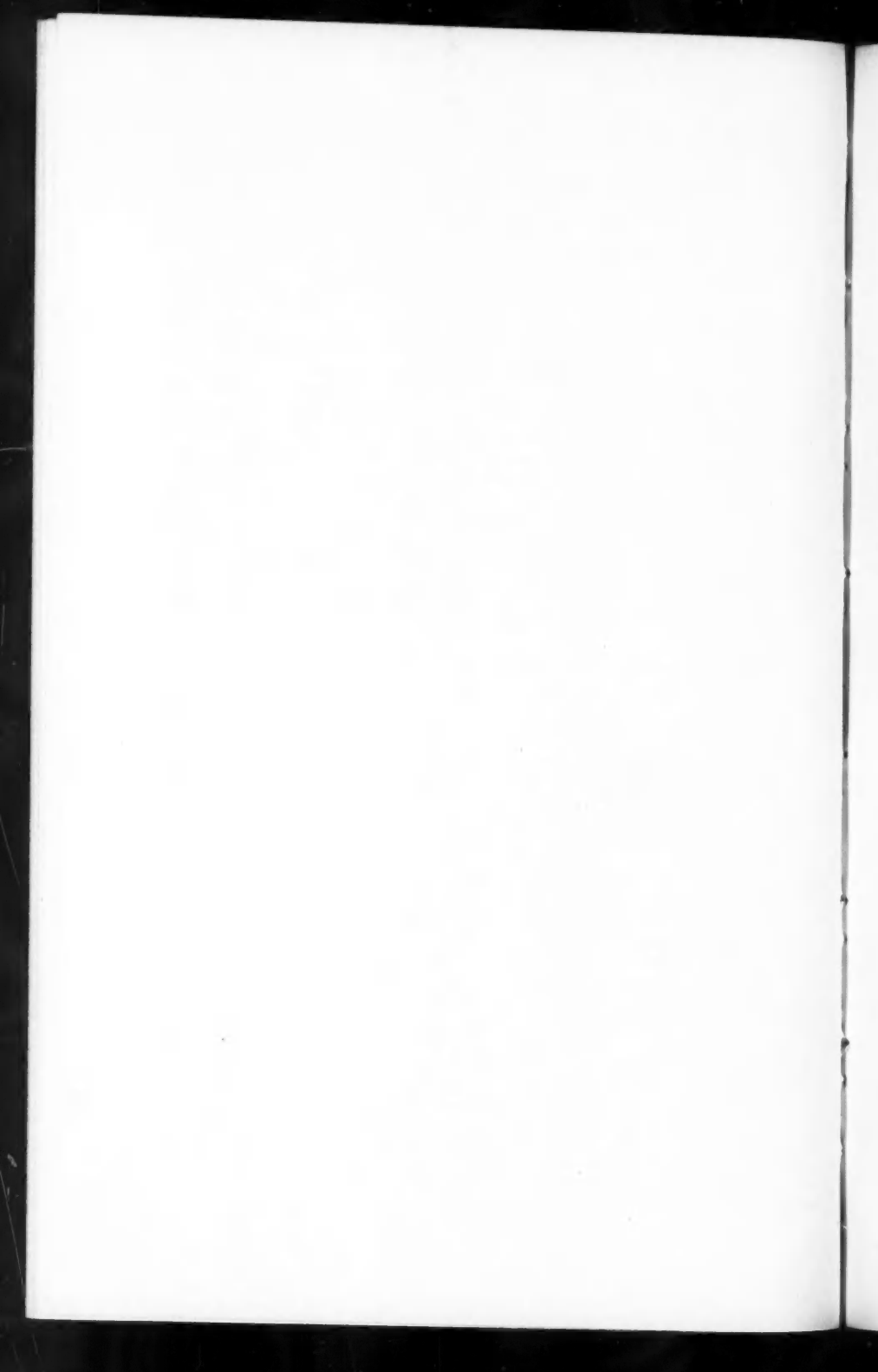
The distance is from twenty-eight to thirty miles. Supposing the cost of a double set of tracks, with proper turns out, to be \$20,000 per mile, the whole expense would be about \$600,000—and there cannot be a doubt, that it would yield, from the time of its completion, at least ten to fifteen per cent. on the cost of construction, and be as safe an investment as probably ever was made.

A New Jersey state convention is to be held at Trenton, on the 25th of this month, on the subject of internal improvement—and it is to be hoped that their attention will be early turned to this object as of primary importance to their citizens. If executed by the state, with funds borrowed on the creation of stocks, it would, in the course of a few years, afford such a surplus beyond the amount of the stipulated interest, as would defray the entire expense of the government. But if the state should be unwilling to undertake it on public account, the whole of the stock would be subscribed in a few hours in New York or Philadelphia.

Should the New Jersey road here recommended be undertaken, and completed, it is to be hoped that our citizens will then be disposed to enter on that proposed from Columbia to Philadelphia, which in the great advantages it would confer on Philadelphia, would be worth treble its cost. On that subject I shall probably shortly submit some calculations to the public, and I doubt not the magnitude of the benefits it would confer on the city, will excite surprise and regret, that it has lain so long dormant.

FULTON.

Philadelphia, September 18, 1827.



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RESOLUTION adopted at the Annual Meeting of
THE RAILWAY AND LOCOMOTIVE HISTORICAL SOCIETY,
at Boston, Massachusetts, January 15, 1933.

—:—

WHEREAS: God, in His infinite providence has seen fit within the past twelvemonth to remove our friend, associate and former Secretary, CHARLES CURTIS EATON; a man beloved by us all, a man whose charm, sincerity and ceaseless energy was a constant inspiration and example to each of us, whose quiet helpfulness was at all times of greatest aid and whose companionship already is missed:

THEREFORE, BE IT RESOLVED:

That the Society spread upon its minutes, this record of its overwhelming loss and transmit a copy of this RESOLUTION to MR. EATON's widow, in addition to publishing it in the next BULLETIN sent to its membership.

BE IT SO ORDERED.

IN MEMORY OF
HENRY W. GLEDHILL
222 BROADWAY
PATERSON, NEW JERSEY
WHO DIED ON JULY 24, 1932.

